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RISK-MANAGEMENT
INFORMATION

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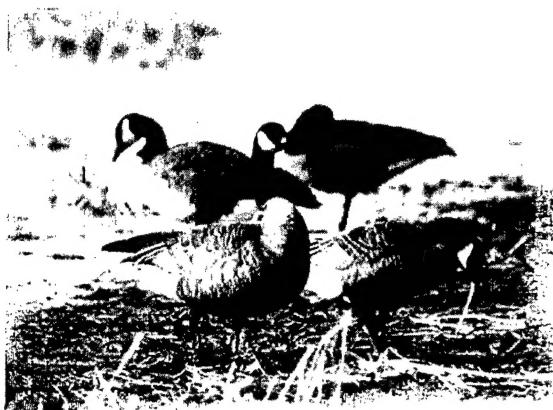
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**Mother Nature's summer aviation hazards—
from bird strikes to thunderstorms**

12th Aviation Battalion, one of the Army's premier operational Support Airlift helicopter battalions, provides air support to the Military District of Washington and the National Capital Region and operates Davison Army Airfield located at Fort Belvoir, VA.



The Birds were winning

Recently, we at 12th Aviation Battalion have concentrated a considerable amount of attention to the problems associated with geese on the airfield. Preventing the mixture of aircraft with geese has driven the battalion to develop and implement a wildlife management program.

Bird strikes have become a major concern and hindrance for both military and civilian aircraft within the United States. To date, bird strikes have claimed over 300 lives in air-crashes since the first known crash resulting from a strike in 1912¹. In addition to this tragic figure, more than 4,900 bird strikes are reported from U.S. based aircraft annually. The distribution of these reports indicates similar numbers for civil and military aircraft. The reports have captured a per-year average of over 2,500 bird strikes by U.S. military aircraft each year, along with about 2,400 bird strikes reported for civil aircraft from 1991-1997². The National

Transportation Safety Board indicates that this may just be the tip of the iceberg when it comes to actual strikes. They believe that the number of strikes reported by civil aviation is about 20% of actual strikes, leaving approximately 80% of actual bird strikes to U.S. civil aircraft unreported. They also estimate that

reported strikes cause over \$300 million in damage to U.S. civilian and military aviation annually. Over the last eight years, the Federal Aviation Administration and the Bird Strike Committee USA have undertaken numerous programs designed to decrease bird strike incidents in Northern America. Their programs have significantly increased the awareness of the problem; however, the drastically increasing population of birds in North America continues to outpace their valiant efforts. It is becoming painfully obvious that, at least for the near future, the birds will continue to be a major presence and threat. In light of this, it is imperative airports and airfields, such as Davison, find innovative ways to safely operate around them.

THE WAKE-UP CALL

Davison Army Airfield (DAAF) at Fort Belvoir, VA, is located about 20 miles south of Ronald Reagan National Airport in Washington, DC. DAAF, which has land coverage of just over 500 acres, is the transient home to many bird species including an abundance of ducks, seagulls, pigeons, and migrating Canadian geese. Over the

past few years, we at DAAF have implemented a variety of measures in an attempt to control the bird hazards on the airfield. Unfortunately, when it came to controlling these birds on or near our runways and aircraft movement areas, we were more reactive than proactive. We would do airfield checks several times an hour to detect any birds in these areas and then deter them using the deterrents of vehicle/human presence and pyrotechnics. During these early stages, we felt like we were doing all we could to reduce the threat to aircraft and human life.

It was not until a near-fatal accident in October 1998 that we truly realized how dangerous our operating environment was to aircraft at or near the airfield. The incident that piqued our awareness began as a routine night approach to our primary runway by a C-12 (twin-engine passenger plane). Unaware of the presence of a gaggle of Canadian Geese (*Branta Canadensis*) at the approach end of the runway, the tower cleared the aircraft to land. Neither the tower nor the crew of the aircraft saw the geese because they were obscured in the darkness. Upon touchdown, the aircraft collided with several of these birds resulting in over \$300,000 damage to the C-12 and a dozen dead geese. Fortunately, there were no human fatalities, but it was painfully clear that we needed to improve our management of the geese population that existed at DAAF.

WILDLIFE MANAGEMENT PROGRAM

Immediately we set out to develop

a program that would meet two primary objectives:

- Provide a safe operating environment for all aircraft utilizing DAAF.
- Reduce avoidable bird strikes on the airfield by exhausting every method available to control and/or eliminate wildlife from DAAF.

With these objectives in mind, we developed a program that consists of a combination of the three facets of wildlife management. These are **detection, harassment, and deterrence**. With these three elements as the framework for our wildlife program, Davison Army Airfield now utilizes a multifaceted approach to eliminate bird strikes on the airfield.

YOU HAVE TO SEE THEM TO AVOID THEM

The most obvious disadvantage an airport faces is the ability to see and avoid our feathered adversaries. Because of their size and natural camouflage, even during the day it is difficult to be able to spot flocks of birds and warn aircrews about their proximity to the runway or traffic pattern. And while it is difficult during the day, this ability becomes nearly impossible at night and during times of limited visibility. In addition, their flocking tendencies and unpredictable flight patterns pose continuous threats to moving aircraft and, ultimately, the crew and passengers within those aircraft.

At Davison, we established wildlife patrols from our airfield services section which ventured out throughout the day and night to detect wildlife on the airfield. As one might expect, this worked very well during the daytime, but was ineffective at night and during

limited visibility. Because the accident with the C-12 occurred during the hours of darkness, we quickly surmised that we needed a more reliable method to be utilized during these times. That's where the use of thermal imagery devices came to our rescue.

THERMAL DEVICES

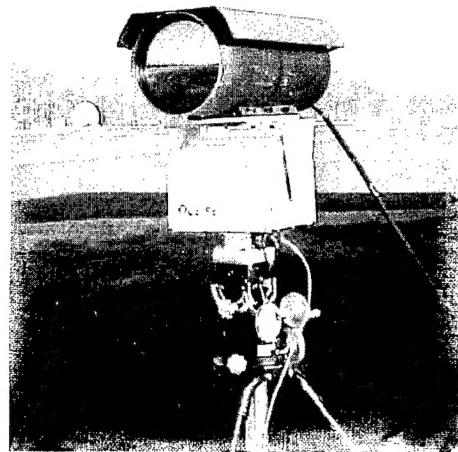
In general, thermal imaging (infrared) devices can be used to allow ground and tower personnel to pinpoint bird locations day or night, thus giving the airport operators the ability to launch countermeasures or simply warn the aircrews. This technology is currently available, and the once-prohibitive cost of these devices has dropped significantly in recent years as technology, capabilities, and availability have continued to increase.

THERMAL IMAGERY USE

The use of thermal imagery with infrared capability to detect all hazards on the airfield quickly became the foundation of our detection techniques. We have acquired the use of and are currently in the testing stages of various types of these thermal devices. The thermal device is placed on top of our control tower where it is secured on a tripod and a motorized 360-degree mount for obtaining a maximum observation area.

The device is controlled remotely by a computer (located in the tower) for automatic continuous surveillance and targets are viewed on this computer's screen. The system also has a manual override for close up viewing of targets. The complete detection system can be configured in many different ways

Loris



to produce the desired results. Our system works effectively with just the thermal imager and monitor in the tower. When configured this way, the tower can do a manual scan of the runway and surrounding area prior to an aircraft taking off or landing. In addition to this device, we have tested 'hand-held' thermal devices (they look similar to home video cameras). Our method of utilizing this asset is to use them while driving around the airfield in airfield services vehicles during our periodic airfield checks. The initial device tested, provided by the Night Vision and Electro-Optics Directorate from the U.S. Army Communications-Electronics Command Research and Development Center, is a test thermal device called "Loris" made by Inframetrics. This device will detect a human at 6.5 kilometers and a goose at about 3 kilometers 24 hours a day in almost any weather condition. Positioned above the tower, this device can clearly recognize just about any heat source on the airfield under nearly any visibility conditions.

The use of thermal imaging equipment has proven to provide airfield personnel the ability to see all activity in the area that could

pose a hazard to approaching or departing aircraft. Since its incorporation into our wildlife management program, the "close calls" for bird strikes have essentially disappeared, as has the potential for tragic collisions of aircraft with flocks of birds.

TO WIN, YOU HAVE TO KEEP THEM OFF BALANCE

Now that we had a better way of detecting the geese on the airfield, we shifted our focus to limiting their presence. To effectively control the wildlife population at DAAF, we implemented an aggressive program that combined harassment techniques with habitat manipulation. Our progress on managing the geese through these methods is nothing short of amazing.

We now use a vast array of non-lethal harassment techniques and deterrent methods. At the heart of our harassment program is the use of highly-trained Border collies. DAAF and Fort Belvoir hired a goose hazard management company called *Windchazer, Inc.* to provide a continuous presence of these Border collies on the airfield. Debra Marshall, president & trainer, has the responsibility of providing constant pressure to any gaggles of geese that land or attempt to land anywhere on the airfield. She and her ubiquitous, highly trained dogs are keeping most of the geese from even landing. But if they do get a

chance to land, the geese are on the ground for only a short time before the dogs chase them away.

Debra, who now manages 11 collies, typically releases four dogs at one time to keep the pressure on the geese. She practices a constant rotating of the dogs as they chase geese. This will keep the dogs from getting tired and will maintain an effective pressure on the geese.

NON-LETHAL HARASSMENT

In addition to the Border collies, we use pyrotechnics, gas cannons, report shells, bird-scaring cartridges, and distress calls. The combination of these non-lethal means of harassment is extremely effective in keeping the birds off guard and scaring them out of the danger areas in the vicinity of the runway and the aircraft movement areas. Of these methods, the gas cannons are the most effective. These cannons are placed in four separate locations around the airfield and can be set on a timer to periodically fire, or can be remotely fired from the tower or from an airfield services vehicle. The distress calls are used in the same way as the cannons and are effective on species of birds other than geese. The other devices are deployed by our roving patrols within airfield services when needed.

The final aspect of our wildlife management program concerning birds is the employment of various forms of habitat management techniques. These techniques are employed in an attempt to reduce or eliminate the attractant nature

of the airfield for the geese. One of the most significant attractants on the airfield was a pond with freestanding water located very close to our active runway. This pond had historically been a favorite location for resident and migratory geese and ducks. In order to eliminate it as an attractant, the pond was drained and vegetation was planted in some areas and allowed to grow in others where the pond was located. This effectively altered the area where it is no longer a large body of water. In addition, we have incorporated new grass-cutting strategies where we attempt to maintain the grass height throughout the airfield between 11 and 14 inches. This additional height, both of the vegetation around the pond and of the grass on the airfield, acts as a deterrent for the birds because it makes it difficult for them to land with such tall obstacles in their landing areas.

One of the biggest lessons learned through our involvement in the wildlife management arena is that there is not one perfect technique to eliminate the bird hazards on an airport or airfield. The success of 12th Aviation Battalion's wildlife management program at Davison Army Airfield is the result of a combination of many different techniques that each contributes in its own way. It is this combination of aggressive efforts that has produced the results needed to effectively maintain control of the geese and provide a safe operating environment for aircraft utilizing Davison Army Airfield.

—CPT James R. Ivey, 12th Aviation Battalion, Davison Army Airfield, Fort Belvoir, Virginia DSN 656-7512, (703) 806-7512, 12bnsafe@belvoir.army.mil

¹ Matthews, Anna W., "Battles Between Airplanes, Birds Hit New Heights", *The Wall Street Journal*, Tuesday, August 10, 1999

² FAA, "FAA Wildlife Strikes to Civil Aircraft in the United States", www.lrbcg.com/nwrcsandusky/strike.html

For more information on thermal devices and/or information on bird control, contact the sites below.

www.inframetrics.com (<http://www.inframetrics.com>)
www.raytheon.com/rtis/docs/thermal.htm
www.faa.gov/arp/birdstrike
www.airsafe.com/
www2.acc.af.mil/
www.birdstrike.org
www.lrbcg.com/nwrcsandusky/strike.html

A Kamikaze (literally, "divine wind") is commonly understood as a member of a World War II Japanese air attack corps. Their wartime objective was to make a suicidal crash on a target, like a ship or a building. Often they delivered their bombs via the plane itself, destroying the aircraft and killing the pilot in the process.

When I was stationed at Camp Humphreys, Korea, the airfield was infested with ring-neck pheasants. These beautiful birds have colorful plumage and a unique white ring around their neck, resembling the white scarf of a kamikaze pilot. Their erratic behavior, waiting on the edge of a runway to dart out in front of passing airplanes and helicopters, intensifies this resemblance.

A GAME OF CHICKEN

During my two years at "The Hump", I hit or grazed one or more of these big, beautiful, and deadly birds. On one occasion, we were flying an RC-12 on a normal VFR approach to runway 32. Everything looked and felt great. At the most precise portion of the approach, just prior to wheels touching, traveling down the runway at 101 KIAS, we spotted two of the feathered enemy. The pair of them headed out onto the runway from the right, just daring us to hit them. At 2,000 feet before reaching their position, we were relieved to see them exit the runway to our left. Whew! It was almost like a game of chicken, no pun intended. We had seen this same game many times in the past.

This time, though, just after our sighs of relief, the two pheasants executed a quick 180-degree turn and darted right into the path of our aircraft. We heard "thump-thump", but didn't know where the hit took place. We had plenty of runway, and didn't want to ingest the carcasses into our engines, so we completed the stop without reversing the props.

Kamikaze bird strikes

After taxiing off the runway, we found the ring-neck couple nestled nicely together in the brake linings of the left landing gear. Maintenance, familiar with the routine, had the RC-12 cleaned up in 30 minutes. Luckily, that's all it cost us this time. Other possibilities could have been very costly and potentially very dangerous.

VISIONS OF VULTURES

On a different occasion, we were flying an ILS instrument approach with a circle to land maneuver at night in a UH-1H. We were headed into Fort Rucker, AL, with our orange cargo doors open. After completing the approach, we started the circling maneuver to the west, keeping our heads on a swivel. While we were concentrating on our intended touchdown point, looking out our right door, "WHAM!" A huge vulture plowed his way into the exact center of our windscreens. (Luckily for us that's where the metal support is.) The bird slid down the windscreens, from center to left, down the fuselage, and plopped right into the cargo compartment. There were guts everywhere! It looked like a scene from a gory movie, like "Predator" or "Alien." There was nothing to do but pass the controls off to my co-pilot, declare an emergency, land, and shut down. A close call and a real attention getter.

BIRD FACTOIDS

Because of these experiences, I got acquainted with Bird Strike Committee USA. This is an organization concerned about bird strikes in the aviation environment, which utilizes a risk management process similar to the Army's. Here is some of what I have learned:

Bird strikes to aircraft have been a concern since the first recorded fatality due to a bird strike in 1912. More recently, bird strikes led to fatal accidents for large military aircraft in 1995 and 1996, and for a commercial airliner in 1988.

Increasing North American bird populations such as geese and ducks have led to significant increases in threat to aircraft, particularly on and near airports.

I was surprised to learn the following facts:

- Bird strikes to aircraft have resulted in over 300 people dying.
- Wildlife strikes are estimated to have cost over \$380 million a year, 1990-1998.
- More than 2,500 bird strikes are reported by the US Air Force each year.
- Over 2,500 bird strikes yearly were reported for US civil aircraft, 1990-1998.



■ An estimated 80% of bird strikes to civil aircraft go unreported.

■ A 12-lb Canada goose struck by an aircraft traveling 150 MPH at lift-off generates the force of a 1,000 lb weight dropped from a height of 10 feet.

■ About 90% of all bird strikes in the US are by species federally

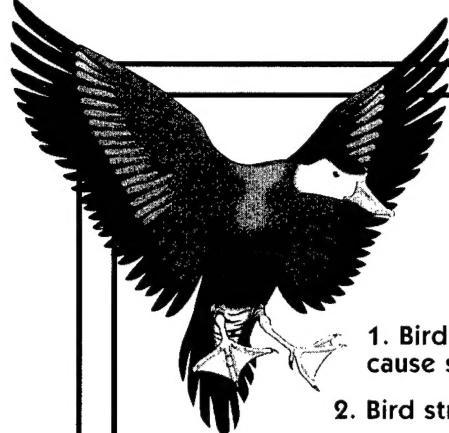
protected under the Migratory Bird Treaty Act.

■ More than half of bird strikes occur at less than 100 feet (30 meters) above ground level. The highest reported bird strike was at 37,000 feet. The highest reported bird sighting was at 54,000 feet. About 6% to 7% of all bird strikes result in aircraft damage.

■ While any airport may have bird strikes, airports adjacent to wetlands or wildlife preserves are at higher risk.

For more information, check out the Bird Strike Committee website, www.birdstrike.org

—CW2 Don Dewitt, Aviation Safety Officer course, Fort Rucker, AL



Bird strike final exam

True or False

1. Bird strikes cannot cause serious accidents.
2. Bird strikes are rare.
3. Bird strikes are less of a problem than 30 years ago.
4. Large aircraft are built to withstand all bird strikes.
5. If a bird flies into an engine of a large plane during takeoff and the engine quits, the airplane will crash.
6. Nothing can be done to keep birds away from airports.
7. It is legal to kill any bird just to protect aircraft.
8. If birds are a problem at an airport, killing them all will eliminate the problem.
9. Bird strikes are more than a nuisance to airline operators.
10. Bird strikes are a concern to people other than those in aviation.

Answers:

1. False. Since 1975, five large jet airliners have had major accidents in which bird strikes played a significant role. In one case, more than thirty people were killed.
2. False. About 20,000 bird strikes to civil aircraft in the US were reported to the Federal Aviation Administration 1990-1998. It is estimated that the 20,000 figure represents less than 20% of the number that likely occurred.
3. False. In North America, bird strikes are increasing. Because of successful wildlife conservation and environmental programs, bird populations of many species have increased dramatically. Species like non-migratory Canada geese have tripled in the last 12 years. The double-crested cormorant population on the Great Lakes has increased a thousand-fold. These and other increases have led to an increase in the number of birds in the vicinity of airports.
4. False. Large commercial aircraft, like passenger jets, are built to withstand the impact of most, but not all, birds. Large modern jets are required to be capable of landing safely after being struck by a 4-lb bird anywhere on the aircraft at normal operating speeds, even though substantial and costly damage may occur.
5. False. Large commercial jets are designed so that if any one engine is unable to continue generating thrust, the airplane will have enough power from the remaining engine or engines to safely complete the flight.
6. False. There are a number of effective techniques to reduce the number of birds in aircraft environments. The three most effective techniques fall into three categories: making the environment unattractive for birds, scaring the birds, or reducing the bird population.
7. False. Some North American bird species which are not protected, such as pigeons or starlings, may be killed if they pose a threat to aircraft. Most birds, such as ducks, geese, gulls, and herons, may be killed in limited numbers by an airport authority, only after obtaining appropriate permits and demonstrating that non-lethal techniques are not adequate. *Endangered species may not be killed under any circumstances.*
8. True. However, even if it were legal to do so, killing off all birds will create other problems. An airport is a part of an ecosystem, and in all ecosystems, each plant or animal species plays a particular role. Eliminating any one-problem species will only lead to some other species taking its place. A combination of bird control measures that take habitat management into account is a superior long-term solution.
9. True. For a modern jet airliner, even minor damage can lead to significant costs. The FAA estimates that bird strikes cost civil aviation over \$300 million per year in the United States.
10. True. The issue of bird strikes is tied into a wide range of policy issues that go beyond aviation. In addition to environmental issues, aircraft accidents as a result of bird strikes can have devastating effects.

Aviation Safety Officer Course

The Aviation Safety Officer Course (ASOC) curriculum provides the fundamental skills necessary to be an effective aviation safety officer and manage aviation safety programs from company to brigade. In the ASOC you will learn about various elements of the Army's Safety program, including risk management, accident investigation and reporting, safety office administration, safety awards, and accident prevention programs. The U.S. Army Safety Center (USASC) has provided the ASOC for the past 24 years. Each year USASC trains nearly 200 ASOs to fill TO&E positions in warfighting units Armywide.

The Army Safety Center conducts four 6-week resident aviation safety officer courses; two 2-week correspondence phase II courses and one 1-week refresher course.

INTERESTED? HOW TO APPLY

Submit a DA Form 4187 through your Personnel Administrative Center (PAC) to request the ASO Course. Course information is contained in DA PAM 351-4: *U.S. Army Formal Schools Catalog*. You must be projected to go into an ASO position or currently serving in an ASO slot to attend the course. Course quotas are set by Department of the Army strength requirements and filled by NGB, PERSCOM, USARC, and IMSO.

To attend the Phase II ASO Course, you must first complete the Phase I Aviation Safety Officer Correspondence Course IAW DA PAM 351-20: *Army Correspondence Course Program Catalog*. Once completed, you must submit

a DA Form 4187 through your PAC to request attendance for Phase II. You must complete Phase I and have course completion validation before you submit your request.

The ASO Refresher Course is open to any school-trained ASO who has been in the field as an ASO more than 4 years or has been out of an ASO position more than 2 years. The ASO refresher course is designed to provide an update on modern safety issues, risk management, regulations, and automation technologies.

Requests for attendance for these courses can be accomplished through your S-3/G-3 training personnel who have access to the Army Training Referral and Registration System (ATRRS).

REPORTING REQUIREMENTS AND PREPARATION

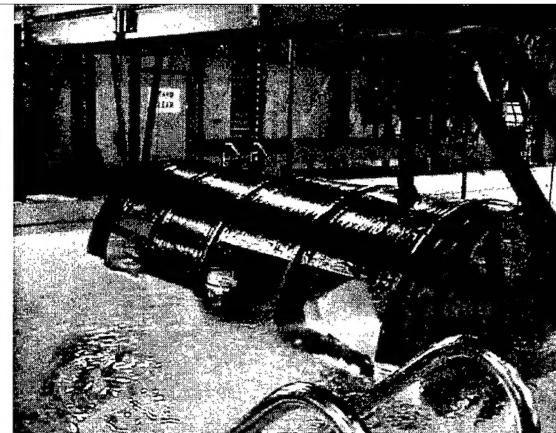
Students attending any of the ASO courses will report to Building 5206, Room 7 at Fort Rucker (USASC classroom annex). All courses begin promptly at 0800 on the designated start dates outlined in the ATRRS. When reporting, you will sign in to the U.S. Army Safety Center.

Before arriving for the course, you should be familiar with the following regulations: AR 385-10, *The Army Safety Program*; AR 385-40, *Accident Reporting and Records*; AR 385-95, *Army Aviation Accident Prevention*; and DA PAM 385-40, *Army Accident Investigation and Reporting*.

COURSE SCHEDULE

Visit our web site for course dates:
<http://safety.army.mil>

Note: The courses normally end at approximately 1200 on the designated end dates. Those using commercial air should not plan departures prior to 1400 to allow sufficient time to make your connections.



Dunker training at NAS Jacksonville

DUTY UNIFORM AND ADDITIONAL REQUIREMENTS

The duty uniform for all courses is BDU. In addition, for the 6-week course, ASOC 7K-F12, the Army Grey PT uniform is required for weigh in and scheduled physical training. For officers attending ASOC, do not forget to bring cold weather PT gear for winter months (i.e., black knit cap, gloves, and Army Grey PT sweats).

The 6-week course includes a trip to the Navy 9N5 Dunker at NAS Jacksonville or NAS Pensacola. You must bring your last up-slip (DA Form 4186) with expiration through the end of the course and a copy of your current physical. You will also need to bring a swimsuit and towel.

TRAVEL ORDERS

The 6-week course students will travel for off-site training at other installations to conduct Aviation Resource Management Surveys (ARMS). To assure that you will be reimbursed for the overnight stays, ensure that your orders include the statement "You are authorized variations to proceed to additional places as may be necessary to accomplish the mission. Dual lodging authorized."

During the course, you will be given approximately 40 pounds of reference material. If you are traveling by air, your orders must contain authorization for mailing these books home.

COURSE COMPLETION REQUIREMENTS

The ASO course is an MOS-producing course; therefore, you will be required to pass all examinations, attend all classes,

and facilitate (via small group discussion) a human resource management topic and complete a writing assignment. Do not plan on scheduling routine appointments during training.

—CW5 Butch Wootten, Director of ASO, USASC, DSN 558-2376, (334) 255-2376, woottend@safetycenter.army.mil

—Mr. Helbig, DSN 558-9868, helbigc@safetycenter.army.mil

—Mr. Dobarzynski, DSN 558-9197, DobarzyR@safetycenter.army.mil

Dusty crash kit

Once a month, I pull out the Crash Investigation Kit, dust it off, open it up, and double-check the things inside. Then I close it up and put it away. That monthly exposure to the light of day is about all the excitement it sees.

Why is that, I wonder?

Why does our crash kit so rarely see the light of day? At first glance, it seems we have a lot working against us.

Our manning, both full- and part-time, is underwhelming. We fly in either blistering heat or bone-chilling cold and in darkness that makes a coal mine seem like a cathedral lit for Easter service. We're either out of fuel money, or AFTP money, or money for copier paper, or some other thing. Parts are scarce, and the QC shop is forever printing out another SOF or ASAM to ground a fleet that just can't seem to get past its latest spate of bugs. Not ideal conditions to allow the Crash Investigation Kit to get dusty. Is it just luck? A few nights ago, the answer came to me in a very unexpected way.

A ROUTINE FLIGHT

One day, I got a late-afternoon phone call asking if I'd like to fly that evening. With the way things are going, it's a rare opportunity to actually fly a real aircraft, so I jumped at the chance. "I'll take the left, and you take the right,

Mark," said the captain. Checklist in hand, we started our respective parts of the preflight. Nearly done with the right side, I noted the captain was still fretting over the tail rotor.

"Look at the PC link that's on top. Tell me what you think," said the captain. Sloppy was the word that sprung to mind, though that's certainly not the technical term for it. The mechanic agreed, and we sought the solace of the hangar for the book answer on axial and radial play.

ACTIVITY IN THE HANGAR

The hangar was alive with activity that night. Perhaps it was some residual excitement from the assistance visit we had just received. Perhaps it was just a coincidence that all the mechanics were at one end of the hangar. While we were thumbing through the book, one of the mechanics, Frank, was rummaging for a dial indicator and set of feeler gauges. From an adjacent bench, Frank asked, "Were you at Harmon's the other night?"

I had to think for a moment. Certainly, the grocery store was on the way home. "Ah, yes—I stopped for some bread on the way home" I replied. And, I'll admit, got hooked at aisle six, looking at the toy helicopters. Frank pressed, "I said to my family, 'That's one of my pilots! He's in my company!'"

The words rang, as I replayed the mental tape, and that my word stuck—twice.

The fact that I wasn't technically in Frank's line company didn't matter. I was his pilot, in his company. We made other small talk, and I watched Frank tend to the nose gearbox he was working on, while my mechanic continued to find exactly the right dimensional reference for the aircraft part that brought us to the hangar to begin with.

The captain and I helped the mechanics—our mechanics—tug the aircraft into the hangar for repair. The facility commander came out, and after a few claps on the back for "a good catch" during a flashlight pre-flight, we eased the hangar door closed and headed for the warmth of the operations office and the required paperwork.

SO THAT'S WHY

I had my answer, but I wasn't expecting to find it in such a casual way. Of course, not every mechanic, pilot, cook, driver or clerk feels as Frank does. But enough of them do. I am my Brother's keeper. I am his pilot. And he is my mechanic. We have an obligation to one another that doesn't quite translate into the written word found in the "Responsibilities" section of the SOP. But that ownership, that obligation to take care of each other, I'm convinced, is the chief reason why the Crash Investigation Kit gets dusty each month.

—CW4 Mark W. Grapin, BN ASO, 1-211, UT ARNG, DSN 766-3663, (801) 816-3663

NCO Corner

Prevent hydraulic fluid contamination

Since the May 2000 *PS Magazine* article (see below) "AGPU joins AOAP" was prepared, the Army has recognized a serious deficiency in our programs to properly maintain the hydraulic systems in our helicopters. While the recently-published AOAP inspection interval for the Aviation Ground Power Unit's (AGPU) hydraulic fluid is now set at 365 days, maintaining the required water content will require an immediate AOAP inspection and frequently recurring inspections.

The Army has experienced numerous in-flight control mishaps over the past few years that have been linked to hydraulic fluid contamination affecting flight control servos and actuators. Water is one of the most significant elements that can cause additional contamination. Once water gets into the aircraft hydraulic fluid, the existing aircraft filters cannot remove it.

An improperly maintained AGPU can be the source of contamination for every aircraft it services. The AGPU has a vented hydraulic reservoir. A canister filled with desiccant is installed on the vent to keep the hydraulic fluid in the AGPU from picking up moisture as the reservoir breathes. When the desiccant is saturated, it allows moisture to enter the AGPU vent and be absorbed by the hydraulic fluid. The next time an aircraft is serviced, some of this water is

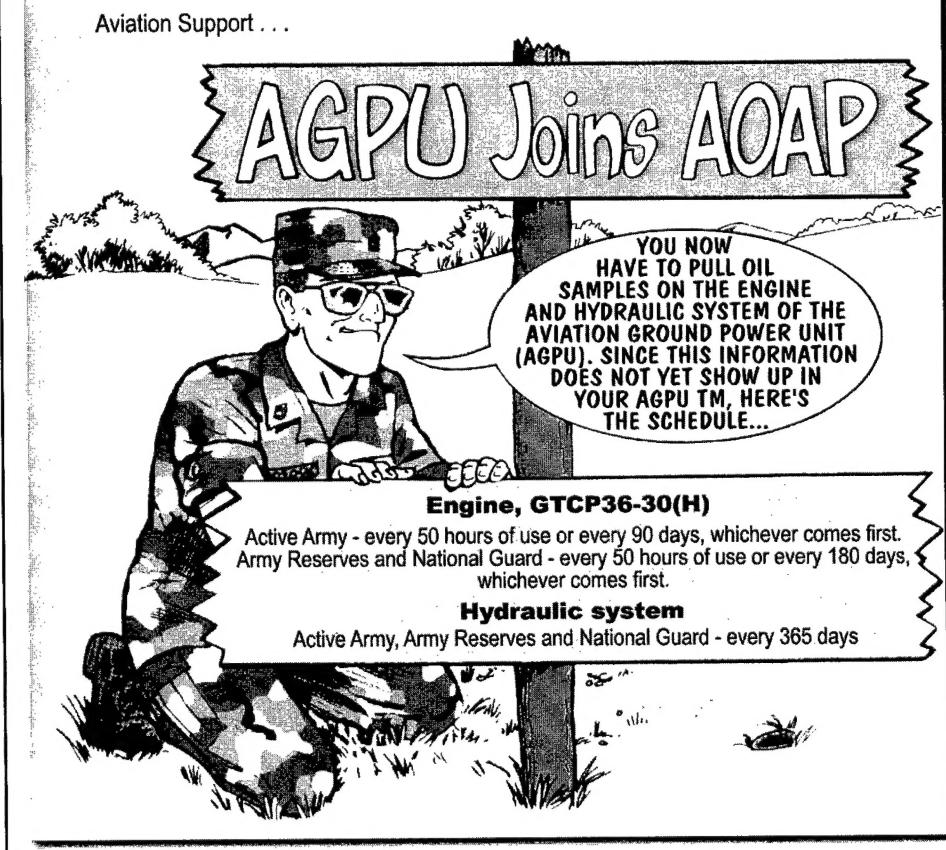
transferred to the aircraft's sealed system, causing corrosion. **It is very important that before any aircraft hydraulic system is serviced that the hydraulic vent dryer is checked to be sure that at least 25 percent of the desiccant is still blue.** If not, replace it with new desiccant. NSN 6650-00-680-2233 gets you a 1.5-lb can of grade H, high adsorption capability, impregnated with a humidity indicator.

While the AGPU has a 3-micron output filter, it can also be a source of particulate contamination through improper handling of the output hoses and connectors. All hose ends need to have their cap or plug installed whenever not in use. All hoses, including the adapter hoses, need to be flushed before being attached to an aircraft to be sure all air is removed and particulate captured in the AGPU's filters. AMCOM is

currently working on "turnaround" adapters to assist in flushing all hoses at the same time. The adapter hoses are required to be used whenever the aircraft system is being flushed and should be used whenever either the primary or utility is being pressurized.

To protect the aircraft systems from overpressure, the pressure relief valve should always be set to no more than 10 percent higher than the servicing pressure. This setup is described in the AGPU TM 55-1730-229-12. Also, the relief valve must be set higher than the service pressure, so that the pump pressure compensator is controlling the servicing pressure. Using the relief valve to control the servicing pressure will cause the AGPU hydraulic system to overheat.

—Jerome Smith, US Army Aviation and Missile Command, DSN 897-4926, (256) 313-4926, Jerome.Smith@redstone.army.mil





When we hear about stress in the cockpit, we automatically assume that stress is part of the job. As Army aviators, we are unable to escape this burden, given the mission requirements that are expected of us in today's Army. If you complain about stress, you are labeled as a weak link in your unit. Every one of us can read about stress in FM 1-301 *Aeromedical Training for Flight Personnel*, where we learn about the important need-to-know information. Why it is important? Is it because it sounds like a good APART question? How often do we consider it in high regard when we are flying a mission and want to land safely on the ground afterwards?

WHAT IS STRESS?

Stress is the effect of physiological, psychological, or mental load on a biological organism. It causes fatigue and tends to degrade proficiency. If "biological organism" sounds too much like a dictionary definition, substitute the word "pilot." Degrading pilot proficiency sounds pretty real in an aviator's life.

Stress can be acute or chronic. Acute stress is short-term and intense. Chronic stress takes place over a long time and, for the most part, goes unnoticed. The more debilitating of the two is chronic stress, to which we usually simply adapt. Many things, such as duty assignments, home life, or illness, can cause chronic stress.

STRESS AND PERSONALITY

Now think about what kind of personalities make up the aviation

field. A typical pilot possesses a Type A personality: a perfectionist, competitive, aggressive, with a fear of making mistakes and of being criticized. Do you really think your Type A buddy is going to turn down much-needed flight time just because his home life is bad?

Or how about someone with a persistent medical problem? Would that person turn down a mission, and risk having the rest of the aircrews say that person was weak?

I speak from experience. When you are trying to be a part of the team, and you have a prolonged illness which nobody thinks is important, what happens when you stop and say "Wait a minute. I don't think I should fly"? You are no longer part of the team. So you push yourself to the limit, trying to hold on as long as you can.

FLIGHT-OR-FIGHT RESPONSE

The occurrence of a stressor activates the sympathetic nervous system's fight-or-flight response. It is characterized by many things—adrenaline release, increased heart rate, and increased respiratory rate, to name a few. This alarm stage is normally followed by a resistance stage, during which the body repairs itself from the damage caused by stress. However, the problem for aviators arises when the arousal continues, as in chronic stress. The body remains in a constant state of readiness, which eventually leads to exhaustion, or burn-out.

Every person has a threshold for stress. Do you know what yours is? Stress affects each person differently. We each have a unique threshold. A threshold is not something you can test. It won't necessarily be the same

each time.

Every pilot can handle a certain number of distractions and still be able to control the aircraft and navigate successfully. But if the situation in the cockpit gets too complex, the pilot will surpass his or her threshold and start making mistakes. Mistakes and aviation do not mix.

STRESS AND FOCUS

Significant life events, which can cause chronic stress, have proven to intrude on attention and distract the pilot from properly monitoring instruments. The term for this is "tunnel vision effect." It has been found that stress can cause an aviator to give an isolated area undivided attention, when the aviator's attention should be more widely distributed. As stress increases, an aviator's ability to attend to secondary tasks decreases and attention becomes more narrowly focused. How many missions have you flown in which you were not task-saturated at one time or another? Something has to give. If a pilot is focused solely on one task, what happens to the others?

STRESS CAN KILL

Stress can kill pilots—not in a violent, obvious way, but rather like a toxic gas—quietly, and usually without a trace. So keep an eye on your fellow aviators, and help them recognize a potential problem. Be aware in the back of your mind that they may be too proud to slow down, or they may simply not realize that they are under stress.

Managing stress is like managing risk. It can be handled if you recognize the problem and take appropriate steps to keep it from becoming catastrophic.

—CW2 Ronda Breneman, 3-7 Cavalry, Fort Stewart, GA, DSN 870-4475, (912) 767-4475

Thunderstorms— a primer

Various terms have been used to describe lightning, but few capture the awesomeness of this natural phenomenon. It's hard to believe that several thousand of these shows of force are flashing at any one time somewhere in the world. They provide a spectacular show, particularly if you're in an aircraft.

Lightning can occur almost any time, but statistics show that lightning occurs most often in clouds, within about 5,000 feet of freezing, in light rain and some turbulence, and within 8 degrees Celsius of the freezing level. Most lightning strikes on helicopters occur below 6,000 feet, but some have occurred as high as 9,000 feet. Rarely are aircraft struck when operating below 1,000 feet AGL.

The risk of a lightning strike seriously injuring a person onboard an aircraft is relatively insignificant. Typical injuries include mild electric shock from the strike and, more likely, temporary blindness from the flash. Such blindness usually occurs at night and lasts only 30 seconds or less. (It's interesting to note that night-vision devices will recover from a lightning flash even faster than the eye.)

There's a chance that a lightning strike could cause physical damage to an aircraft. Lightning is most likely to strike sharp or pointed areas, such as wing and rotor tips, elevators, and rudders. Theoretically, a lightning bolt should pass through aircraft

metal structures without causing damage. But that is not always the case, as evidenced by the occasional wrinkled, burned or split aircraft skin, shattered structures such as radomes, and damage to wiring or electronic equipment.

The best protection against a strike is to avoid lightning altogether, and doing so isn't as difficult as one might think. Lightning rarely occurs without some or all of the following conditions being present:

- Clouds
- Precipitation, particularly the icy kind
- OAT near zero degrees Celsius
- Progressive build-up of static
- Light turbulence
- Altitude between 10,000 and 15,000 feet

If combinations of these conditions cannot be avoided, take as many of the following actions as possible:

- Avoid areas of heaviest precipitation
- Reduce airspeed to slow static build-up
- Avoid freezing level by at least 8 degrees Celsius
- Turn up cockpit lighting

If a strike occurs, monitor equipment for malfunctions. In addition, if you encounter unforeseen conditions, report them so that other aviators can be warned.

Note: Weather posters are available for download from our website:
<http://safety.army.mil>

—Reprinted from March 1998

Tips on Thunderstorms— When in doubt, turn about

For aviators, the safest course of action is to turn away from a thunderstorm area. To go a few miles away out of your way, or land and wait it out, is far smarter than taking the shortest and most direct way through a storm area. Thunderstorm tips include:

- Lowering ceiling and rain showers may indicate thunderstorm activity.
- Don't be fooled by gentle winds and rain; you could be flying into the teeth of a severe thunderstorm.
- Excessive radio static is a sure sign of lightning, telling you a thunderstorm is in the area. The ADF needle will point in the direction of a thunderstorm when lightning is present.
- Don't land or take off in the face of an approaching thunderstorm. Associated low-level turbulence or wind shear could cause loss of control of the aircraft.
- Don't attempt to fly under a thunderstorm, even if you can see through to the other side. Turbulence and wind shear under the storm could be disastrous.
- Remember, destructive hail can be tossed from thunderstorms into adjacent clear areas. Bear this in mind if you're ever tempted to sneak between thunderstorms.
- Don't trust appearance to be a reliable indicator of the degree of turbulence associated with a thunderstorm.
- If a thunderstorm is identified as severe, avoid it by at least 20 miles.

The most deadly threat soldiers face in peacetime is traffic crashes. Privately owned vehicle (POV) crashes kill more soldiers than all other accidents—on- and off-duty—combined. The Chief of Staff, Army has made clear his determination to end this needless loss of soldiers and the adverse impact it has on readiness.



Preventing POV deaths

The Chief of Staff, Army outlined the following six-point model program aimed at reducing POV accidents and directed its use in every unit as the minimum standard.

1. COMMAND EMPHASIS: Positive, unrelenting emphasis by leadership at all levels is imperative. When junior officers and noncommissioned officers take advantage of daily opportunities to assert positive influence on how, when, and where soldiers operate their POVs, it can have a lasting effect. They should know where their soldiers go, what they do, and then assert positive influence on how, when, and why they operate their POVs.

2. DISCIPLINE: Negative behavior such as traffic offenses, alcohol abuse, misconduct, and poor performance often are indicators of potential POV accident victims. Leaders' intervention by identifying "at risk" soldiers, counseling them, and taking proactive measures to modify their risky behavior has been effective in units successfully combating POV accidents.

3. RISK MANAGEMENT: Use risk management. The POV Risk Management Toolbox for Commanders and Leaders provides leaders and safety personnel support in the form of tools, training, guidance, accident data, and print and audiovisual media. You can find the toolbox at <http://safety.army.mil/pages/pov/index.html> and the Risk Management Information System at <http://rmis.army.mil>. Use it and make it available to leaders at all levels.

4. STANDARDS: Set high and unmistakable standards. Enforce them. Be uncompromising on the use of seatbelts and motorcycle safety equipment. Educate soldiers on the risks of speed, fatigue, and use of alcohol. Conduct mandatory POV safety inspections and random roadside checks. Emphasize the use of designated drivers for social events.

5. PROVIDE ALTERNATIVES: Provide alternatives for soldiers driving POVs and using alcohol. Schedule activities on post to keep soldiers

on post and off the road. Keep gyms, recreation centers, and other places soldiers use off-duty open later. Promote use of alternate transportation methods to POV use. Prominently post public transportation schedules. Where possible, use morale, welfare, and recreation services to provide buses or vans to transport soldiers to the places they go when off-duty. Explore arranging reduced hotel rates in nearby communities to encourage soldiers to remain overnight on weekends and stay off the highways late at night.

6. COMMANDER'S ASSESSMENT: Following every fatal and serious-injury POV accident, the Chief of Staff, Army directed that commanders conduct an assessment of the accident with the involved soldier's chain of command. Determine what happened, why it happened, and how it could have been prevented. Implement corrective and preventive measures. Publicize lessons learned.

—Mr. James Brown, Traffic Safety Manager, USASC, DSN 558-2046, (334) 255-2046, brownj@safetycenter.army.mil.

The key to successful POV accident prevention programs is the commander's active involvement. Positive, hands-on leadership at all levels is imperative, particularly at the squad leader or first-line supervisor level.

Vehicle Refueling Fires

The dispensing of gasoline into the fuel tank of a motor vehicle is a safe operation. Americans pump gasoline into their cars between 16 and 18 billion times a year generally without incident. The oil companies' track record in this regard is enviable.

I am now in my twenty-second year at the Petroleum Engineering Institute (PEI). Up until September, 1999, the only refueling fires that were reported to me were caused either by an open flame (smoking), lack of electrical continuity between the nozzle and the grounded dispenser, or a spark from the engine compartment (motor running).

From September, 1999 through January 22, 2000, 36 ignitions of gasoline vapors during the refueling process were reported to me at PEI. All occurred during dry weather. There were no open flames and the engines were off. Continuity was verified between the nozzle and dispenser. People that investigated the cause of these accidents concluded that static electricity was the source of ignition in all cases.

These fires raised questions about why they are occurring now and didn't occur in the past. They include:

■ **Fuel chemistry.** Has the chemical composition of gasoline changed in a way that the conductivity of the fuel has also changed?

■ **Finish of the driveway or forecourt.** Is the paved surface of the refueling area sufficiently dissipative?

■ **Tires.** Tires are being made

with less carbon (conductive) and more silica (non-conductive). Does this make a difference?

■ **Electrically insulated conductive components.** Are all conductive parts, and in particular all metal parts, in the area of the vehicle's tank system connected in an electrostatically dissipative manner so that the insulated conductors are not a source of ignition? We hear that this can be a problem even if the vehicle is grounded.

■ **Plastic filler inlets.** Today, some fuel tank filler necks are made of non-conductive plastics with a metal trapdoor opening. Some are connected to molded fiberglass fuel tanks. Could refueling transmit a charge to the insulated plastic filler neck that, in turn, might cause a spark to jump to the grounded nozzle?

■ **Customers re-entering their vehicles during refueling.** An electrostatic charge is generated through friction between clothing and the car seat to such an extent that electrostatic discharges to the vehicle body or to the filling nozzle are possible, especially if the motorist is wearing rubber-soled shoes. A Midwestern oil company warned of this hazard in a November 24, 1999, memo stating: *“...a flash fire can result from this discharge if sufficient flammable vapors are present. Therefore, customers should be discouraged from re-entering their vehicles while fueling is underway.”*

About half of the fires that have been reported to PEI involved the motorist re-entering the vehicle at some point during the

refueling process.

Although Americans pump gasoline into their cars between 16 and 18 billion times a year without incident, the fact that these fires were occurring in the first place—and with what occurred to be greater frequency—caused PEI to gather additional information about the circumstances surrounding these fires. We asked our newsletter readers and others to report to us all refueling fires presumably caused by static electricity.

WHAT WE FOUND OUT

PEI received 47 first-hand reports of refueling fires attributed to static electricity. We also obtained information from the National Traffic Safety Administration database on similar incidents occurring between 1993 and April 1, 2000. Seventy-six percent of the fires occurred during the five months between November and March.

In all the reports we were able to verify, no open flames, running motors, or electrical continuity problems were involved. All but one of the accidents occurred with conventional (not Stage II vapor recovery) nozzles. Driveway surfaces included concrete, asphalt, stone, crushed rock, and dirt. Fires occurred with many different types of nozzles, hoses, breakaways and dispensers. No cell phones were involved. The refuelers wore a wide variety of clothing. In 94% of the accidents for which footwear was identified, refuelers were wearing rubber-soled shoes.

WHY DOES THIS HAPPEN?

I am not an expert on static

electricity. It does appear to many people in the industry, however, that electrostatic charging was the probable cause of these fires. In many of the reports we received, the fueler became charged prior to or during the refueling process, through friction between clothing and the car seat, to such an extent that electrostatic discharges to the vehicle body, fuel cap, or dispensing nozzle occurred. Twenty reports described fires that occurred before the refueling process began, when the fueler touched the gas cap or the area

close to it after leaving the vehicle. Twenty-nine fires occurred when the fueler returned to the vehicle during the refueling process and then touched the nozzle after leaving the vehicle. Fifteen fires do not involve either of these two situations.

PEI has recently received five excellent articles written over the last four years, which attempt to explain these types of fires. Most were written in response to similar refueling fires in Germany, the United Kingdom, and France from 1992 through 1997.

WHERE DO WE GO FROM HERE?

PEI will continue to collect reports of fires, as well as theories and studies about why these fires happen. A summary of many of the documents I have referenced here is available on the PEI web site: www.pei.org

I will mail a full set of these documents on request.

—Robert N. Renkes, Executive Vice President and General Counsel, Petroleum Engineering Institute, Tulsa, OK (918) 494-9696, rrenkes@pei.org

Accident briefs

Information based on preliminary reports of aircraft accidents

AH1



Class E F series

■ During two-minute cool down following a maintenance test flight, transmission oil pressure caution light illuminated. Aircraft was shut down. Maintenance replaced transmission oil pump.

■ At the end of the training period, IP selected emergency governor for emergency governor training. Governor would not go into emergency mode. Aircraft was taxied to parking pad and shut down. Failure was caused by shorted wire in emergency governor wire harness.

AH64



Class E A series

■ During run-up, target acquisition designation sight (TADS) would not boresight. Aircraft was shut down without further incident. TADS unit was replaced.

■ While on the ground, engines running, aircraft's shaft driven compressor light illuminated at shut down. Aircraft was shut down without further incident.

■ During taxi, main transmission

chip light illuminated. Aircraft was shut down without further incident.

■ During run-up, Pilot's Night Vision System (PNVS) was found to be inoperable. PNVS turret assembly was replaced.

D series

■ Stabilator failure occurred during run-up. Aircraft was shut down without further incident. Flight management computer was replaced.

■ The trailing edge of a blade was found damaged after the completion of a training flight. The crew had been operating on an unimproved landing surface and a confined area.

CH47



Class C D series

■ Lowered ramp contacted the ground during landing sequence. Left ramp strut mounting bracket was dislodged from the mounting point. Structural damage was identified at the attaching points.

E series

■ Following rapid fuel operations, PC noted No. 1 engine N1 gauge at 0% and #1 engine oil pressure at 0 PSI. When engine was shut down, noises

were heard coming from No. 1 engine. Crew was unable to lag the rotor system. Maintenance suspects failure of No. 1 engine oil pump resulting in failure of bearings within the N2 section of engine. Maintenance replaced engine.

■ During multi-ship air-assault, pilot noticed a static failure of the No. 1 engine. PC continued adjusting N2 with manual beep trim adjustment and returned to home station. Maintenance replaced the N2 actuator.

■ During attempted load hookup, master caution capsule illuminated with no corresponding segment light. Master caution capsule could not be reset. Aircraft was returned to field site. Maintenance replaced the master caution panel.

■ During cruise flight, aircraft had a 12% torque split when N1s and fuel flows were matched. When power was reduced, the torque split became 40% and could not be matched with the normal beep trim. Crew switched to emergency engine trim on No. 1 engine and returned to airfield without further incident. Maintenance replaced No. 1 engine and No. 2 actuator.

■ During cruise flight, small bird flew into aft rotor blade, impacting leading edge of blade.

OH58



Class C

D (I) series

- During demo autorotation, the engine was overtorqued.

D (R) series

- While conducting calibration checks in hovering flight, the FADEC audio warning activated, followed by an engine and rotor overspeed.

- During manual throttle training at a hover, engine torque spiked to 134%.

Class E

C series

- During hover, RPM switch was found to be inoperable. Aircraft was shut down without further incident. Replaced linear actuator.

- During NOE flight, transmission oil light illuminated. Aircraft landed without further incident. Replaced freewheeling unit power takeoff seals.

- High amp reading occurred during hover. Aircraft landed without further incident. Generator field circuit breaker wire was replaced.

- While on the ground, with engines running, gyro was found to be inoperable. Aircraft was shut down without further incident. Radio bearing heading indicator was replaced.

- While on the ground with engines running, engine chip light illuminated. Aircraft was shut down without further incident. Magnetic plug was replaced.

D (II) series

- During hover, DC generator fail message displayed. Aircraft landed without further incident. Replaced DC remote control circuit breaker.

■ During takeoff, PI felt binding in the cyclic when moved left. During downwind both pilots felt severe control feedback in the cyclic and burning smell entered the cockpit. A precautionary landing was made and the aircraft was shut down without further incident. Maintenance repaired hydraulic pump.

■ During flight at NOE, aircraft experienced an engine overtorque of 126% for 3 seconds, and a mast overtorque of 120% for 3 seconds. After precautionary landing, aircraft was inspected by maintenance personnel and returned to flight. Mission was delayed. Suspect high winds/turbulence contributed to this incident.

TH67



Class C

A series

- During hover training, aircraft contacted the ground. Hard landing resulted in damage to landing gear and tailboom.

UH1



Class E

V series

- The aircraft was in straight and level flight when the fire warning light illuminated. The aircraft landed immediately without incident. The aircraft was landed in a field and an emergency shut down was performed.

For more information on selected accident briefs, call DSN 558-9855 (334-255-9855). Note: Information published in this section is based on preliminary mishap reports submitted by units and is subject to change.

UH60



Class C

L series

- During approach for landing, rotorwash blew a blade box cover into a parked AH-64A, damaging one tail rotor blade, vertical fin, and stabilator.

Class E

A series

- While at cruise flight, main transmission pressure dropped down to 20 PSI with a corresponding temperature that also increased indicating up to 130°. Aircraft landed with no further events. Maintenance inspection revealed the main MDL, No. 1 and No. 2 input MDLs and the No. 1 and No. 2 accessory MDLs needed to be replaced. Aircraft was recovered back to base.

- No. 1 engine fire light illuminated on short final. Fire was not present. Aircraft was shut down and inspected. Maintenance analysis confirmed no fire existed. Fire sensor was disconnected and reconnected to reset system. Suspect sunlight shining on photo sensor activated fire detection system.

L series

- Stabilator failed in flight and would not reset. During one-time flight back, stabilator failed again in flight and would not slew below 30 degrees down. Lower stabilator actuator replaced.

Post Script to "The U.S. Army Flight Surgeon"

In the May issue of *Flightfax*, I wrote about how important it is for the flight surgeon to participate in the Commander's Accident Prevention Plan, or CAPP. The newest edition of AR 385-95, *Army Accident Prevention*, does not address the commander's duty to prepare a written CAPP. This doesn't mean that the aviation accident prevention program is gone. Instead, commanders must ensure accident prevention, through risk management, is a part of every mission of the unit. Accident prevention is not a stand-alone policy. The duties of commanders are addressed in paragraph 1-6a of AR 385-95. Other requirements for commanders are contained in paragraphs 1-4 (Responsibilities) and 1-5 (Policy).

Flight surgeons are an important part of any accident prevention program. If you don't have a flight surgeon assigned, the local Medical Department Activity Commander or your Command Surgeon are required to coordinate and provide support for the aviation medicine programs at the local level. This includes flight surgeon support for accident prevention programs.

—MAJ Matthew Mattner, US Army Aviation Resource Management Survey Inspector, Fort Rucker, AL, DSN 558-7418 (334) 255-7418, matthew.mattner@se.amedd.army.mil

Are you up on your UH-60 MWOs?

At a recent workshop with AMCOM the subject of MWOs came up. There are currently 12 MWOs active. Seven of these should have been already completed. You say, so what? Well, there are two that are still open on UH-60 aircraft that date back to 1993. The Aviation and Missile Command and the Safety Center continue to track these until they are 100% complied with. Please scrub your aircraft books to ensure that the following MWOs have been completed:

MWO Number	Item Description	Projected Completion date	% Completed (3/00)
55-1520-237-50-44	Anti-Flap Bracket	1/93	99%
55-1520-237-50-49	Mixer Assembly Flight Controls	10/93	99%
1-1520-237-50-59	EME Protection (Phase II)	2/95	99%
1-1520-237-50-64	Engine Cowling Latch	5/97	99%
55-1520-237-50-66	Improved Fire Extinguisher Circuit	4/98	95%
1-1520-237-50-71	Improved Rotor Control System	9/98	99%
1-1520-237-50-70	Improved Center Windshield	7/98	98%

Who is responsible? Unit commanders and maintenance officers are. Let's get 'em fixed and be 100%!

—Bob Giffin, Utility Systems Safety Manager, USASC, DSN 558-3650, (334) 255-3650, giffinr@safetycenter.army.mil

Corrections

Congratulations to all the sharp-eyed readers of April's Flightfax who noticed the incorrect answer to question 4 in the Final Exam on IFR. The correct answer is "c".

And further congratulations to SFC William G. Sikes III. He was recognized as Aviation Soldier of the Year in May's edition. He belongs to D Company, 2/160th SOAR(A). His fellow soldiers, proud of his achievements, pointed out we had placed him in the wrong regiment.

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POV Fatalities through 30 Apr

FY00	FY99	3-yr Avg
64	70	59



U.S. ARMY SAFETY CENTER

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